


## **Appendix K**

### **Musick Facility Expansion Wastewater Analysis**

# *Robert Bein, William Frost & Associates*

PROFESSIONAL ENGINEERS, PLANNERS & SURVEYORS

## MEMORANDUM

**To:** Bob McVicker, IRWD  
**From:** John Nagle   
**Date:** August 7, 1996  
**Subject:** James A. Musick Facility Expansion

JN 32816

As you are aware, the County of Orange has filed a Notice of Intent to prepare a draft environmental impact report (EIR) for the proposed expansion of the Musick Facility. The James A. Musick Facility is a minimum security jail operated by the County. The facility is proposed to be expanded from its current capacity of 1,256 inmates to a total population of 7,584. In addition the facility will include a 24-bed Interim Care Facility (ICF) and a 20,000 square-foot Sheriff's Station.

Robert Bein, William Frost and Associates (RBF) has completed an evaluation of the ability of the Irvine Ranch Water District (IRWD) to provide water and sewer service for the proposed expansion.

### I. Background

The IRWD currently serves the Musick Facility on the basis of two existing agreements with the County. The "Agreement for Acquisition of Interim and Permanent Sewer Service by County of Orange for James A. Musick Facility from Irvine Ranch Water District" allows a daily wastewater discharge of 0.03 million gallon per day (MGD). The "Agreement for Acquisition of Potable Water Service from Irvine Ranch Water District for James A. Musick Facility" provides the facility with a capacity in IRWD facilities to deliver 0.27 cubic feet per second (cfs) of potable water.

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## II. Projected Population and Demand Phasing

### 1. Population Phasing

It is anticipated that the Musick Facility will be expanded in phases. The first segment consists of the Sheriff's Station (20,000 s.f.), the Interim Care Facility (ICF), which includes 24 beds, and the first segment of the jail expansion. The jail expansion is proposed to be expanded in three Segments. Segment 1 includes the addition of 864 inmates to the existing 1,256 inmates, for a total of 2,120 inmates. Segment 2 includes expanding the facility to accommodate a total of 3,744 inmates. The third and final segment will accommodate 3,840 more inmates, for a total of 7,584 inmates. It should be noted that these Segments may be built in any sequence, however no inmates will occupy the new buildings before 1999.

### 2. Water and Wastewater Demand Factors

In establishing water demand factors and wastewater generation rates, we reviewed duty factors used by the County Sanitation Districts of Los Angeles County (CSDLAC), as well as several past studies completed by RBF which evaluated the following similar facilities:

- Theo Lacy Branch Jail, County of Orange
- California Men's Colony, San Luis Obispo, CA
- Fred C. Nelles School, Whittier, CA
- East Mesa Detention Facility, Otay, CA

Information in these studies includes actual record data, which correlated total water usage to the inmate population for each facility. In this way, a duty factor was developed which can be expressed in terms of gallons per day per inmate. Therefore, by definition, this duty factor includes allowances for facility staff and daily visitors. Based on a comparison of the data contained in these studies, we have assumed an average daily demand factor of 100 gallons per capita per day (gpcd) and an average wastewater generation rate of 85 gpcd. Water and wastewater duty factors for the Sheriff's Station are 250 gpd/1,000 s.f. and 200 gpd/1,000 s.f., respectively. Also, for the purposes of this analysis, we have assumed that the number of staff and daily visitors is directly proportional to the number of inmates, and will increase as the inmate population is expanded.

### 3. Water Demand Phasing

Based on the number of inmates and a duty factor of 100 gpcd, the average, maximum, and peak hour demands were estimated, as summarized on the Table 2. For the purposes of this study, the maximum daily demand was assumed to be 2.0 times the average annual demand, and the peak hour was assumed to be 3.0 times the average.

### 4. Wastewater Flow Phasing

The wastewater generation from each phase is summarized on Table 3. The average and peak wastewater generation from the Musick Facility were estimated for each phase based on the number of inmates and a duty factor of 85 gpcd. The peak wastewater generation was estimated using the following equation:

$$\text{Peak Flow} = 1.84 \times (\text{Average Flow})^{0.92} \quad (\text{with flowrates in cfs})$$

## III. Evaluation of Existing Water and Wastewater Systems

### 1. Water Supply System

The Musick Facility is currently supplied by a connection to the IRWD Zone IV domestic water system, located near the northwest corner of the site. The Zone IV system is supplied by a storage reservoir, located about one-half mile from the site, which has a High Water Level of 640 feet. A second connection in the same location is currently under construction and will supply the on-site fire system. An onsite fire loop is currently under construction to increase the system's ability to provide adequate fire flows. An evaluation of the Musick Facility's fire protection system, prepared by RBF (December 1992), recommended that a third connection to IRWD's Zone IV system be installed at the southerly property line to increase the fire protections system's reliability.

Presently, the Musick Facility does not have any non-domestic water supply. It should be noted that until recently, IRWD supplied non-potable water from a connection to the Baker Aqueduct (formerly the Santiago Aqueduct), which delivers non-potable water to south Orange County and runs along the northerly property line. The non-potable water was used for irrigation and to supply the fire system. This connection was abandoned due to pipeline damage, and as a result, the second connection to the IRWD domestic system described above,

is required. The IRWD does not have any reclaimed water facilities in the immediate area, however, such facilities may be installed in the future. At its current level of usage, 1,256 inmates, the IRWD has the capability meet the maximum daily and peak hour demands, and provide reliable fire flow protection.

## **2. Wastewater Collection System**

The on-site wastewater collection system for the Musick Facility consists of 8- and 10-inch vitrified clay pipelines (VCP) located within the existing streets. These pipelines convey wastewater flows, by gravity, to a 10-inch trunk sewer that exits the facility along Musick Road, extends parallel to an IRWD 15-inch trunk sewer along the southerly boundary, and connects to the 15-inch trunk sewer at the intersection of Alton Parkway and Trabuco Road. The on-site 8- and 10-inch pipelines are owned and maintained by IRWD, while the onsite collection laterals that are 6 inches in diameter or smaller are considered private facilities.

The IRWD trunk sewer that serves the Musick Facility also serves the Foothill Ranch Development located upstream. The trunk sewer consists of a 21-inch trunk sewer located within Bake Parkway, a 15-inch trunk sewer along the lower property line of the Musick Facility, a 15-inch trunk sewer located along Alton Parkway, and a 18- and 21-inch trunk sewer along the Serrano Channel. The 21-inch trunk sewer connects to the 33-inch San Diego trunk sewer at the intersection of the channel and the Interstate 5 Highway. The wastewater is ultimately treated at the Michelson Water Reclamation Plant, which is owned and operated by IRWD. The existing IRWD collection system currently can accommodate existing wastewater flows generated by the Facility.

## **IV. Impact of Future Demands on Existing IRWD Facilities**

In a letter of response, dated July 10, 1996, to the Notice of Preparation of the Draft EIR, IRWD has indicated that it will meet the needs of the Musick Facility through all phases of expansion. RBF has completed an analysis of the existing IRWD water and sewer facilities, which evaluates their ability to provide this service and identifies any future improvements.

In addition to the wastewater flows generated by the expansion of the Musick Facility, IRWD is considering redirecting flows from the Portola Hills (Glenn Ranch) development area, which is currently sewered to the Santa Margarita Water District (SMWD) collection system. The

Portola Hills development is located in the foothills northeast of El Toro, and flows would be introduced at the upstream end of the collection system serving the Musick Facility. Based on the Glenn Ranch Subarea Master Plan, prepared by RBF in April 1989, the average and peak wastewater generation for the entire site is 1.86 cfs and 3.37 cfs, respectively.

## 1. Water System

Fireflows govern the sizing of transmission mains and reservoir storage requirements, and no change in fireflow requirements are anticipated due to the expansion. Domestic demands are considerably lower than the fireflow demands, and their increase does not impact facility sizing or the need for additional improvements. Therefore, the existing offsite domestic water facilities are adequate to serve the Musick Facility through all phases of expansion. However, the proposed service connection at the southerly property line should be installed prior to the expansion to provide the necessary reliability. This service connection, as identified in the 1992 RBF study, should also connect to the domestic system, and be sized to deliver ultimate domestic demands plus fireflow.

As mentioned earlier, the IRWD currently does not have the facilities to provide reclaimed water service to the Musick Facility. However, facilities in the future may be extended to the areas surrounding the site. Potential reclaimed water uses include irrigation and the onsite fire protection system.

## 2. Wastewater System

A sewer model was analyzed of the Alton Parkway Trunk Sewer System to verify the capacity of the existing IRWD collection system and to determine the ability for the existing IRWD's wastewater collection system to adequately serve the existing wastewater flow at the Musick Facility. The Model was based on the data included in Appendix D of the IRWD's *1992 Sewer Collection System Master Plan* (September 1992).

Based on this analysis, several critical reaches were identified. These reaches, based on their diameter, slope and projected flowrate, would be the first to reach maximum capacity. These reaches are identified on Table 4.

In designing new sewer facilities, the IRWD utilizes the depth to diameter ratio ( $d/D$ ) at the estimated peak flow rate at ultimate build out to determine the capacity of a gravity sewer:

- $d/D = 0.50$  for a diameter of 12-inches or less;
- $d/D = 0.67$  for a diameter of 15-inches;
- $d/D = 0.75$  for a diameter of 18-inches or greater.

However, in the evaluating an existing sewer, it is standard practice to consider actual flowrates and timing to ultimate build out of development to eliminate unnecessary paralleling.

Our capacity analysis identifies some reaches of the sewer, downstream of the Musick Facility, that are either already at maximum capacity (Reach 8038) or that are surcharged (Reach 5076). This reach was previously identified as deficient in the 1992 Master Plan, which recommended that this pipe be paralleled within the 2010 Planning Period. It is also important to note that the capacity analysis is based on ultimate wastewater generation, whereas the tributary area has really not reached ultimate build out yet.

The results of our analysis also show that the capacity of the Alton Parkway Trunk Sewer System will have to be expanded to accommodate the projected flows from the ultimate expansion of the Musick Facility. However, it should be noted that proposed revised land use plans in the Foothill Ranch Development and the potential for flows from Portola Hills to be redirected to the Alton Parkway System make it very likely that numerous reaches of the existing system would require parallel, even without the expansion of the Musick Facility.

Because the expansion of the Musick Facility can occur in any sequence, we have identified a break point of 2,850 additional inmates. This number represents the maximum expansion of the inmate population that can be accommodated by the existing sewer system, without having to parallel any existing sewer facilities. The breakpoint was estimated based on the assumption that no new upstream flows are directed to the system.

At the breakpoint of 2,850 inmates, the capacity in the "critical" reaches slightly exceeds original design criteria, however, they are not in danger of surcharging (with the exception of Reach 5076 as previously identified).

## V. Conclusions

Based on the information contained in this analysis, the following conclusions are offered:

1. The existing off-site IRWD domestic water facilities are adequate to serve all phases of expansion of the Musick Facility. However, we recommend that the proposed third on-site service connection be installed prior to expansion, and sized for ultimate domestic demands plus fireflow.
2. The District currently has no reclaimed or non-potable service available to the Musick Facility. However, in the future these facilities will possibly be available, and consideration should be given potential reclaimed water use areas and providing for future service connections.
3. The existing IRWD wastewater collection system is adequate to accommodate additional flows generated by the Musick Facility expansion, through a breakpoint of 2,850 additional inmates.
4. System improvements, including the construction of several parallel reaches, will be required to accommodate the wastewater flows generated by the ultimate expansion of the Musick Facility.
5. Numerous reaches in the existing system will be surcharged if flows from Portola Hills area introduced into this collection system, regardless of whether the Musick Facility is expanded or not.
6. The existing agreements for water and sewer service between the District and the County must be amended, or new agreements must be executed, due to the increase in water demands and wastewater generation caused by the expansion.

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### Attachments

cc: Andi Culbertson, CAA  
Mike Rudinica, RBF



**TABLE 1**  
**JAMES A. MUSICK FACILITY EXPANSION**

**SUMMARY OF CUMMULATIVE JAIL CAPACITY  
BASED ON PROPOSED PHASED IMPROVEMENTS**

**Existing:**

Population = 1,256 Inmates

**Phase I:**

Population = 2,120 Inmates  
Sheriff's Station = 20,000 square feet  
Interim Care Facility = 24 beds

**Phase II:**

Population = 3,744 Inmates  
Sheriff's Station = 20,000 square feet  
Interim Care Facility = 24 beds

**Ultimate:**

Population = 7,584 Inmates  
Sheriff's Station = 20,000 square feet  
Interim Care Facility = 24 beds

**TABLE 2**  
**JAMES A. MUSICK FACILITY EXPANSION**  
**SUMMARY OF ESTIMATED WATER DEMANDS**

Condition		Demand Factors		Average Water Demand (gpd) (cfs)		Maximum Water Demand (cfs)	Peak Hour Demand (cfs)
<b>Existing:</b>							
Jail	1,256 inmates	100 gpd/inmate		125,600	0.194	0.39	0.58
<b>Phase I:</b>							
Jail	2,120 inmates	100 gpd/inmate		212,000	0.33	0.66	0.98
Sheriff's Station	20,000 sq.ft.	250 gpd/1,000 sq.ft.		5,000	0.01	0.02	0.02
ICF	24 inmates	100 gpd/inmate		2,400	0.004	0.01	0.01
<b>Subtotal After Phase I Expansion</b>				<b>219,400</b>	<b>0.34</b>	<b>0.68</b>	<b>1.02</b>
<b>Phase II:</b>							
Jail	3,744 inmates	100 gpd/inmate		374,400	0.58	1.16	1.74
Sheriff's Station	20,000 sq.ft.	250 gpd/1,000 sq.ft.		5,000	0.01	0.02	0.02
ICF	24 inmates	100 gpd/inmate		2,400	0.004	0.01	0.01
<b>Subtotal After Phase II Expansion</b>				<b>381,800</b>	<b>0.59</b>	<b>1.18</b>	<b>1.77</b>
<b>Ultimate:</b>							
Jail	7,584 inmates	100 gpd/inmate		758,400	1.17	2.35	3.52
Sheriff's Station	20,000 sq.ft.	250 gpd/1,000 sq.ft.		5,000	0.01	0.02	0.02
ICF	24 inmates	100 gpd/inmate		2,400	0.004	0.01	0.01
<b>Subtotal At Ultimate Expansion</b>				<b>765,800</b>	<b>1.18</b>	<b>2.37</b>	<b>3.55</b>

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**TABLE 3**  
**JAMES A. MUSICK FACILITY EXPANSION**  
**SUMMARY OF ESTIMATED WASTEWATER GENERATION**

Condition		Wastewater Generation Factors		Average Wastewater Generation		Peak Wastewater Flow [1]	
				(gpd)	(cfs)	(gpd)	(cfs)
<b>Existing:</b>							
Jail	1,256 inmates	100 gpd/inmate		125,600	0.194	0.39	0.41
<b>Phase I:</b>							
Jail	2,120 inmates	85 gpd/inmate		180,200	0.28		
Sheriff's Station	20,000 sq.ft.	200 gpd/1,000 sq.ft.		4,000	0.01		
ICF	24 inmates	85 gpd/inmate		2,040	0.003		
<b>Subtotal After Phase I Expansion</b>				<b>186,240</b>	<b>0.29</b>	<b>378,500</b>	<b>0.59</b>
<b>Phase II:</b>							
Jail	3,744 inmates	85 gpd/inmate		318,240	0.49		
Sheriff's Station	20,000 sq.ft.	200 gpd/1,000 sq.ft.		4,000	0.01		
ICF	24 inmates	85 gpd/inmate		2,040	0.003		
<b>Subtotal After Phase II Expansion</b>				<b>324,280</b>	<b>0.50</b>	<b>630,500</b>	<b>0.98</b>
<b>Ultimate:</b>							
Jail	7,584 inmates	85 gpd/inmate		644,640	1.00	1.99	2.99
Sheriff's Station	20,000 sq.ft.	200 gpd/1,000 sq.ft.		4,000	0.01	0.01	0.02
ICF	24 inmates	85 gpd/inmate		2,040	0.003	0.01	0.01
<b>Subtotal At Ultimate Expansion</b>				<b>650,680</b>	<b>1.01</b>	<b>2.01</b>	<b>3.02</b>

[1]  $Q_{peak} = 1.64 \times (Q_{avg})^{0.82}$ ; (Q in cfs)

**TABLE 4**  
**JAMES A. MUSICK FACILITY EXPANSION**  
**SUMMARY OF AVAILABLE CAPACITY IN CRITICAL REACHES**

Critical Reach No: [1]	Location of Reach	Size (in)	Slope	Reach Capacity (cfs)	Percent Full d/D	Allocated Capacity (cfs)	Available Capacity (cfs)	Equivalent No. of Additional Inmates	Remarks
8306	Musick Road	10	0.0052	0.79	50.0%	0.36	0.43	1,706	Breakpoint = 2,850 inmates
				1.06	60.0%	0.36	0.7	2,848	
				1.24	66.7%	0.36	0.88	3,624	
				1.44	75.0%	0.36	1.08	4,498	
8038	Alton Parkway	15	0.006	3.95	66.7%	3.99	--	--	Breakpoint = 2,850 inmates
				4.56	75.0%	3.99	0.57	2,684	
				4.60	75.5%	3.99	0.61	2,878	
5088	Alton Parkway/ Serrano Channel	18	0.0062	7.54	75.0%	7.51	0.034	102	Breakpoint = 2,850 inmates
				8.08	80.0%	7.51	0.574	2,852	
5076	Serrano Channel	18	0.0019	4.18	75.0%	7.57	--	--	Surcharged at Ultimate Flows w/o Musick Expansion
				4.92	95.0%	7.57	--	--	

Estimated Wastewater Generation Rate = 85 gpd/inmate

Peak flowrate, Q<sub>pk</sub>, based on the empirical equation:  $Q_{pk} = 1.84 \cdot (Q_{av})^{0.92}$ , with Q<sub>av</sub> in cfs.

[1] Reach numbers are based on the numbering system used in the 1992 Wastewater Master Plan.

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